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REMARKS

The Office Action of February 19, 2003 has been received and carefully reviewed. It is submitted that, by this Communication, all bases of rejection and objection are traversed and overcome. Upon entry of this Amendment, Claims 1-10, 15-25, 27-29, 31, 32, 34-54 and 65 remain in the application. New claims 66-68 have been added in order to set forth specific additional embodiments of Applicants' invention.

At the outset, Applicants note the withdrawal of the previous § 103 rejections in view of the Appeal Brief filed on December 2, 2002.

The Examiner states that the reference identified as "New Sorbents for Olefin/paraffin Separations by Adsorption via π -Complexation," Yang and Kikkinides, AIChE Journal, March 1995, in the IDS of October 6, 2000 appears to be incorrectly identified because the Examiner asserts that the authors of the reference are Joel Padin and Ralph Yang, and that the page numbers are incorrect.

It is respectfully submitted that the Examiner is incorrect, in that he is erroneously assuming that two distinct papers are one and the same. The Padin and Yang reference to which he refers is NOT the 1995 AIChE Yang/Kikkinides paper. Rather, the Padin/Yang paper is entitled "New Sorbents for Olefin/Paraffin Separations by Adsorption via π -Complexation: (I) Synthesis and Effects of Anions and Substrates". Further, the Padin/Yang manuscript to which the Examiner refers was published in Chemical Engineering Science, Volume 55, page 2607 in 2000 (not in 1995, as the Examiner asserts at page 8 of the Office Action). As such, there is no correction required. ✓

Claims 11-25, 27, 28 and 30-63 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-26 of U.S. Patent No. 6,215,037. Claims 1-14, 29 and 30 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-19 of U.S. Patent No. 6,423,881. The Examiner states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the patented claimed processes by utilizing the presently claimed feed because it would be expected that the results would be the

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same or similar when using a feed that comprises a small amount of hydrogen sulfide because a small amount of hydrogen sulfide would not affect the outcome of the claimed process of the U.S. patent.

Neither of the '037 or '881 patents teach or suggest a method of separating hydrocarbons as claimed in a gaseous mixture which includes hydrogen sulfide present in amounts normally present in conventional cracked gas streams, as recited in Applicants' invention as defined in claims 1, 15, 34 and 48 as amended. ✓ ①

Support for the recitation of a conventional cracked gas stream may be found at page 13, lines 12-22 in the specification as filed.

The skilled artisan recognizes that the presence of sulfur compounds is generally known to have deleterious effects in various petroleum refining processes. See, for example, the specification as filed at page 3, lines 3 et seq. In this area of the specification, the Applicants teach that the presence of sulfur at amounts greater than about 2 or 3 ppm is generally harmful to material(s) used in refining processes. In contrast, a conventional cracked gas stream before any desulfurizing distillation steps contains hydrogen sulfide present in amounts of about 0.01 mole% (100 ppm). (See specification at page 13, lines 12-22). ✓

Applicants' invention as defined in claims 29 and 32 recites that the hydrogen sulfide is present in amounts up to about 66 mole%.

Since neither of the '037 or '881 patents teach or suggest hydrocarbon separations in a gaseous mixture containing hydrogen sulfide present in amounts normally present in conventional cracked gas streams, much less in amounts up to about 66 mole%, it is submitted that Applicants' invention as defined in independent claims 1, 15, 29, 32, 34 and 48, as well as in any claims ultimately dependent therefrom, has obviated the rejection under the judicially created doctrine of obviousness-type double patenting.

Since claims 15, 34 and 48 were only rejected under obviousness-type double patenting, and it is submitted that this rejection has been overcome, it is submitted that Applicants' invention as defined in claims 15, 34 and 48, as well as in any claims dependent therefrom, is now in condition for allowance, notice of which is respectfully requested.

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Claim 65 stands rejected under 35 U.S.C. § 112, first paragraph as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. The Examiner asserts that the limitation "the gaseous mixture is contained in a conventional cracked gas stream before any desulfurizing distillation step" was not described in the specification at the time the application was filed.

Applicants respectfully take issue with the Examiner's assertion. The Examiner's attention is directed to the specification as filed at page 13, lines 15-22. As such, it is submitted that the Examiner's § 112, first paragraph rejection is erroneous, and withdrawal of the same is respectfully requested.

Claims 11-14, 30 and 33 stand rejected under 35 U.S.C. § 102(b) as being anticipated by "New Sorbents for Olefin/Paraffin...", Joel Padin and Ralph T. Yang. Claims 55-64 stand rejected under 35 U.S.C. § 102(b) as being anticipated by "Materials and Interfaces..." Chen and Yang, Ind. Eng. Chem. Res., 35, 402-027 (1996).

Applicants do not acquiesce to the Examiner's rejections. However, it is submitted that the rejections of claims 11-14, 30, 33 and 55-64 are moot in that these claims have been canceled without prejudice in the present Communication.

Applicants respectfully submit to the Examiner that Applicants' invention as defined in claims 1, 15, 29, 32, 34 and 48 is predicated on the fact that it is not necessary to desulfurize to extremely low levels:

[T]his novel adsorbent fortuitously and unexpectedly substantially maintains its adsorbent capacity and preference for the alkene in the presence of the sulfur compound. This is highly desirable, as this sulfur tolerant and/or resistant adsorbent (as well as the other novel adsorbents described hereinbelow) obviates step(s) conventionally necessary to desulfurize the cracked gas stream(s). (emphasis added) page 10, lines 28-36

The Examiner is further directed to the instant application at page 13, lines 13-22:

The novel adsorbents were exposed to very severe amounts, for example the hydrogen sulfide was present in amounts up to about 66 mole%. **In sharp contrast, a conventional cracked gas stream before any desulfurizing distillation steps contains hydrogen**

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sulfide present in amounts of about 0.01 mole% [100 ppm]. As such, the data presented hereinbelow indicate that the novel adsorbents of the present invention would be quite robust, ie. very tolerant and/or resistant to H₂S under normal operating conditions. (emphasis added)

Claims 1-7, 10, 29 and 65 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over "New Sorbents...", Padin/Yang in view of Ogawa (U.S. Patent No. 6,042, 797). The Examiner admits that Padin does not disclose that the gaseous alkene comprises a sulfur compound [the Examiner is reminded that the claims recite hydrogen sulfide]. However, the Examiner asserts that Ogawa discloses a process for removing ethylene from a gaseous mixture containing ethylene and a sulfur compound (for example sulfur oxide) by contacting the gaseous mixture with an adsorbent. Therefore, the Examiner states that it would have been obvious to the skilled artisan to have modified the process of Padin by using an olefinic feed comprising a sulfur compound because, as taught by Ogawa, sulfur compounds would not affect the outcome of the process.

Applicants remind the Examiner that the Padin/Yang reference was not published until 2000, and that the subject application was filed August 7, 2000. As such, it is submitted that the Padin/Yang reference is not available to the Examiner as a proper § 103(a) reference. However, assuming *arguendo* that the reference were available, the Padin/Yang manuscript nowhere teaches, suggests or discloses a method for separating hydrocarbons in the presence of hydrogen sulfide present in amounts normally present in conventional cracked gas streams. Absent any such teaching, the skilled artisan is well aware (as discussed above), that hydrogen sulfide poisons sorbents, catalysts, etc., thus generally rendering them ineffective. It was highly unexpected and counter-intuitive to discover that the sorbents as recited in the pending claims substantially maintain their adsorbent capacity and preference for the alkene or diene in the presence of the hydrogen sulfide.

Applicants reiterate from the last amendment that Ogawa does not teach or suggest a gas containing hydrogen sulfide, and should thus be removed as a primary reference. Ogawa states at Col. 6, lines 24 et seq.:

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Specifically, [the gas] may be a gas containing ethylene, for example, the atmosphere, an exhaust gas, or a gas in a storage chamber of the crops. The adsorbent is effective also in a case where the gas contains not only ethylene but also carbon monoxide, carbon dioxide, hydrogen, oxygen, nitrogen oxide, sulfur oxide. . .

In Ogawa, the olefins are being removed from the atmosphere or an exhaust gas. Exhaust gas contains by-products of burning: sulfur oxides, carbon oxides, etc. In Applicants' invention as defined in claims 1, 15, 29, 32, 34 and 48, it is recited that the adsorbent substantially maintains its adsorbent capacity and preference for the alkene or diene in the presence of hydrogen sulfide. This is remarkable in that hydrogen sulfide has been recognized as being capable of potentially deactivating entire adsorbents. Thus, hydrogen sulfide has been recognized as reacting detrimentally; whereas sulfur oxide is generally recognized as being substantially an inert by-product.

Further, Ogawa et al. themselves teach that sulfur oxide itself is not necessarily that inert. Ogawa '797 teaches silver exchanged ferrierite (or ZSM-5) zeolite only, for adsorption of ethylene. In Example 26, the inventors used Ag-ZSM-5 as a catalyst for NO reduction in flue gas. In this example, they included 25 ppm SO₂ in the gas feed. They showed very low catalytic activities (the NO conversion was very low at a very low space velocity, or very long contact time). The inventors did not remark on the effect of SO₂ addition. Yet, from their own data, SO₂ clearly poisoned the catalyst. It is submitted that this teaches away from the Examiner's assertion that Ogawa teaches that sulfur compounds would not affect the outcome of the process.

As such, Applicants' invention as defined in the independent claims wherein the sorbents retain their capacity and preference for the alkene or diene in the presence of hydrogen sulfide present in amounts normally present in conventional cracked gas streams is fully unexpected and surprising.

Regarding claim 29, the Examiner admits that neither Padin nor Ogawa disclose that the sulfur compound is hydrogen sulfide and its amount in the feed is up to about 66 mole%. However, the Examiner asserts that it would have been obvious to one having ordinary skill in the art at the time the invention was

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made to modify the process of Padin by using an alkene feed stock comprising a small amount of hydrogen sulfide. The Examiner gives an example of a small amount as being 0.001 ppm, because it would be expected that a small amount of hydrogen sulfide present in the feedstock would not affect the outcome of the Padin process.

Claims 27, 28 and 32 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Milton (U.S. Pat. No. 2,882,243). Regarding claim 32, the Examiner asserts that Milton does not disclose that sulfur compounds and its amounts are contained in the feedstock. However, the Examiner states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the Milton process by utilizing a feedstock containing a tiny amount of hydrogen sulfide (for example 0.01 ppm) because it would be expected that the tiny amount of hydrogen sulfide present in the feedstock of Milton would not affect the outcome of the process of Milton.

The Examiner seems to be ignoring the claim recitation that the hydrogen sulfide is present in amounts up to about 66 mole%. It is entirely irrelevant that 0.001 ppm or 0.01 ppm hydrogen sulfide may not affect the outcome of the Padin process.

Applicants further do not acquiesce to the Examiner's conclusion, as it begs the issue, and is also not practical. As stated in Applicants' application at page 3, lines 5-10:

[I]n catalytic reforming, the catalyst used is often platinum supported on high-purity alumina. However, the platinum on the catalyst is seriously deactivated by sulfur compounds, and therefore the feedstock is desulfurized to less than 3 ppm by weight of sulfur before the reforming.

In order to preserve the expensive platinum in a catalytic reforming process, the desulfurization is taken substantially to the limits--in other processes, one would generally not see feedstocks having as low as 3 ppm hydrogen sulfide. As such, it would be extremely expensive and time consuming, if not impossible, to desulfurize feedstock to a level of "0.01 ppm" or "0.001 ppm" as suggested by the Examiner.

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As such, it is submitted that Applicants' invention as defined in claims 29 and 32, as well as in any claims dependent therefrom, is not anticipated, taught, or rendered obvious either by Padin and/or Ogawa, either alone or in combination, and patentably defines over the art of record.

Regarding claim 65, the Examiner states that Padin does not disclose that the alkene feedstock is a conventional cracked gas stream before any desulfurizing distillation steps. However, the Examiner asserts that it would have been obvious to one having ordinary skill in the art to have modified the process of Padin by using the claimed feedstock because of the similarity between the claimed feedstock and the modified Padin feedstock, it would be expected that the results would be similar when using the claimed feed.

Applicants respectfully submit that the Examiner's assertion is illogical. Neither Padin or Ogawa teach, suggest, or disclose anything about hydrogen sulfide. Further, as shown in the specification itself and as is generally known in the art, hydrogen sulfide in amounts greater than about 2 or 3 ppm deleteriously affects sorbents, catalysts, etc. in refining processes. As such, the skilled artisan would NOT expect that the results would be similar when using a feedstock containing hydrogen sulfide present in amounts normally present in conventional cracked gas streams. As such, it is submitted that Applicants' invention as defined in claim 65, as well as in newly presented claims 66-68, obviates the Examiner's rejection.

Claims 8 and 9 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 1 above, and further in view of Ramachandran et al. (5,744,687).

Claims 1-7, 10, 29 and 65 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ogawa et al. (6,042,797) in view of "New Sorbents for Olefin/paraffin separations by adsorption..." Padin/Yang (it is respectfully submitted that this reference was NOT published in March 1995 as asserted by the Examiner at page 8, line 12 of the Office Action, but rather was published in 2000. (The Ralph T. Yang and E.E. Kikkinides, article as cited in Applicants' IDS, entitled "New

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Sorbents for Olefin/paraffin separations by adsorption..." was published in the AIChE Journal, March 1995, Vol. 41, No. 3, pp. 509-517.)

It is reiterated that the Padin/Yang 2000 publication should not be available as a 103(a) reference, given that the subject application was filed in 2000. However, since the Applicants have hereinabove set forth arguments rebutting the citation of Ogawa, and reiterate those arguments here (thereby, it is submitted, removing Ogawa as a primary reference), it is submitted that the rejection of Ogawa in view of any secondary reference is obviated. As such, it is further submitted that the citation of the 2000 Padin/Yang reference is a moot issue.

Neither Ogawa nor any of the other cited references disclose adsorbents which substantially maintain their adsorbent capacity and preference for the alkene or diene in the presence of hydrogen sulfide as recited in Applicants' claims 1, 15, 29, 32, 34 and 48. As such, it is submitted that Applicants' invention as defined in claims 1, 15, 29, 32, 34 and 48, as well as in any claims ultimately dependent therefrom, is not anticipated, taught or rendered obvious by Ogawa or Padin/Yang 2000, either alone or in combination, and patentably defines over the art of record.

Further, Applicants submit that the recitation in claims 29 and 32 of hydrogen sulfide present in amounts up to about 66 mole% renders these claims and any dependent therefrom allowable. None of the cited references teach or suggest adsorbents which can function in an atmosphere having up to about 66 mole% hydrogen sulfide present (as stated above, in fact they do not even mention hydrogen sulfide). As such, it is submitted that claims 29 and 32, and any claims dependent therefrom, are in condition for allowance.

For all the above reasons, it is submitted that Applicants' invention as defined in claims 1-10, 15-25, 27-29, 31, 32, 34-54 and 65-68 is not anticipated, taught or rendered obvious by any of the cited references, and patentably defines over the art of record.

In summary, Claims 1-10, 15-25, 27-29, 31, 32, 34-54 and 65 remain in the application. New claims 66-68 have been added in order to set forth specific additional embodiments of Applicants' invention. Claims 1, 15, 31, 34 and 48 have

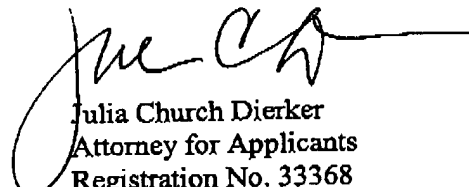
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been revised. Claims 11-14, 30, 33 and 55-64 have been canceled without prejudice. It is submitted that, through this Communication, Applicants' invention as set forth in these claims is now in a condition suitable for allowance.

Further and favorable consideration is requested. If the Examiner believes it would expedite prosecution of the above-identified application, he is cordially invited to contact Applicants' Attorney at the below-listed telephone number.

Respectfully submitted,

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Dated: June 11, 2003
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